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United States Patent [19][11] **Patent Number:** **5,095,303****Clark et al.**[45] **Date of Patent:** **Mar. 10, 1992**[54] **SIX DEGREE OF FREEDOM GRAPHIC OBJECT CONTROLLER**[75] Inventors: **Michael R. Clark**, Glendale; **Musa Mustafa**, Laverne, both of Calif.[73] Assignee: **Apple Computer, Inc.**, Cupertino, Calif.[21] Appl. No.: **499,931**[22] Filed: **Mar. 27, 1990**[51] Int. Cl.⁵ **G09G 5/00**[52] U.S. Cl. **340/710; 340/709**[58] Field of Search **340/710, 709, 706, 711; 74/471, 471 R; 273/148 B; 364/578**[56] **References Cited****U.S. PATENT DOCUMENTS**

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[57] **ABSTRACT**

A six degrees of freedom interactive display controller

device is disclosed, comprising a hand manipulable housing unit having an opening for the passage of a mouse ball, two motion detectors for detecting the movement of the mouse ball and converting that motion to output signals controlling the translational movement of an object on the display of a computer, a finger operated conveyor belt or roller for controlling the translational motion of the object with respect to a third translational axis, a first finger controlled mechanism, such as a wheel and motion encoders, affixed to the housing for controlling the rotational motion (pitch) of the object with respect to a first one of the translational axes, a second finger controlled mechanism affixed to the housing for controlling the rotational motion (roll) of the object with respect to a second one of the translational axes, and a third finger controlled mechanism affixed to the housing unit for controlling the rotational motion (yaw) of the object with respect to a third one of the translational axes. All translation and rotation controls are operable to be physically moved in a direction which corresponds to the desired simulated direction of movement of the object on the display. The physical motion of each control is unbounded and the actual physical position of the housing unit is independent of the simulated position of the object on the display.

32 Claims, 3 Drawing Sheets

